

# Evaluation of the effectiveness of tilt training and education in prevention of reflex syncope in patients with vasovagal syndrome hospitalized in the Department of Coronary Heart Disease and Heart Failure in 2010–2015

Ocena skuteczności zastosowania treningów pionizacyjnych oraz edukacji pacjenta w prewencji omdleń odruchowych u chorych z zespołem wazowagalnym, hospitalizowanych w Klinice Choroby Wieńcowej i Niewydolności Serca w latach 2010–2015

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## Abstract

**Introduction.** Tilt training (TT) is a form of therapy usually proposed to patients with malignant or recurrent form of reflex syncope syndrome, which causes deterioration of quality of life and carries the risk of injuries. Traditionally, TT involves maintaining an upright posture against the wall for the extending period of time. The use of TT in the therapy of reflex syncope has been mentioned in the guidelines of the European Society of Cardiology only as a possible method of treatment in a selected group of patients (IIb, B).

The aim of the study was to assess the effectiveness of the therapy including intensified in-hospital tilt training and simultaneous patient education in prevention of reflex syncope.

**Materials and methods.** The study included 33 patients (19 women) aged 17–69 (average 40) with vasovagal syncope syndrome who were hospitalized in 2010–2015 in the Department of Coronary Heart Disease and Heart Failure in order to undergo TT therapy and syncope prevention education. The average number of TT sessions was 4 (1–9). Treatment effects were assessed using telephone survey and the medical records analysis. The effectiveness of the applied therapy in reflex syncope prevention and adherence to the therapy have been established, including the level of anxiety due to syncope recurrence, quality of life after treatment and subjective effectiveness of the applied therapy.

**Results.** The mean follow-up period was 1.6 years. During the follow-up 22 patients (66.7%) continued TT, 30 (91%) applied anti-syncope maneuvers, 29 (88%) increased the liquids consumption, 17 (51.5%) were trying to avoid high-risk for syncope situations. Twenty-four patients (72.7%) had no recurrence of syncope during the follow-up period. Twenty-nine patients (88%) reported improvement in the quality of life. Thirty-one patients (94%) experienced reduction in the anxiety level associated with the possibility of recurrent syncope. Average rating of usefulness of the undergone therapy, assessed by the patients, in the prevention of reflex syncope was 9.3 out of 10.

**Conclusions.** 1. High adherence to the syncope prevention recommendations is an important cause of the low recurrence rates of syncope in the study group of patients with vasovagal syncope. 2. The use of the non-pharmacological therapies such as tilt training and patient education has an important role for improving the quality of life and for reduction of the anxiety in patients with vasovagal syncope. 3. Needs to be highlighted a very high subjective assessment of patients with vasovagal syncope regarding the relevance and effectiveness of the applied therapy.

Key words: tilt training, reflex syncope, vasovagal syncope, head-up tilt test

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## Introduction

Tilt training (TT) as a preventive treatment of recurrent reflex syncope was first applied by Ector et al. [1] in 1998. In a group of patients with severe form of vasovagal syncope (VVS) syndrome, a series of in-hospital TT was performed (90 sessions in total) and the patients were instructed to continue TT at home. The success of the therapy proposed by Ector et al. was impressive, because it resulted in complete elimination of reflex syncope episodes in all 13 patients. Unfortunately, results of subsequent studies on these methods were not so evident [2–4]. Considering that alternative effective therapies are lacking, TT still remains one of the basic methods used in the treatment and/or prevention of recurrent reflex syncope [5], despite low class of recommendation in the European Society of Cardiology (ESC) guidelines (IIb, B).

Tilt training is a form of therapy usually proposed to patients with malignant or recurrent form of reflex syncope syndrome, which causes deterioration of the quality of life and carries the risk of injury. Traditionally, TT involves maintaining an upright posture against the wall for the extending period of time. The methodology of TT has never been standardized. Various training protocols are proposed in the literature, most of them are intended to be performed at home. One of the most frequently used protocols is the protocol proposed by Abe et al. [6]. According to this protocol, the patient performs two training sessions daily, gradually increasing the time of upright position to target period of 30 minutes per session. This methodology of home TT is recommended to all patients diagnosed with VVS syndrome in the laboratory of the Unit of Diagnostics and Treatment of Syncope, the Department of Coronary Heart Disease and Heart Failure, the John Paul II Hospital in Cracow.

Additionally, taking into account high effectiveness of the therapy in the study of Ector et al. [1], patients with particularly severe symptoms and a high rate of syncope recurrence are proposed to hold a number of training sessions in the hospital, with the assistance of medical personnel and the appropriate monitoring (ECG, blood pressure, cerebral oxygen saturation). Simultaneously, patients are educated on syncope prevention.

The aim of the study was to assess the effectiveness of the therapy including intensified in-hospital TT followed by continuation of TT at home in the prevention of reflex syncope.

The aim of the study was not only to assess the effectiveness of the therapy, expressed by the reduction in the incidence of syncope episodes, but also to evaluate other, more subjective endpoints such as the reduction in the level of anxiety associated with recurrent syncope and improvement of the quality of life of patients. Patient conviction about the effectiveness of this type of therapy was also assessed.

## Material and methods

Qualified for the study were all 51 patients hospitalized between August 2010 and August 2015 in the Department of Coronary Heart Disease and Heart Failure, the John Paul II Hospital in Cracow in order to undergo TT therapy.

We managed to contact 40 of 51 pre-enrolled patients. Three patients refused to participate in the study. Additionally, excluded were 5 patients in whom further diagnostics revealed non-reflex mechanism of syncope. Finally, 33 patients were included in the analysis (19 women and 14 men). Mean age of the patients was 40 years (17–69). Among the study participants, 30 were diagnosed with vasovagal syncope syndrome, 2 had only orthostatic hypotension, 2 had vasovagal syndrome with orthostatic hypotension, and in one patient data on the mechanism of reflex syncope were lacking. The distribution of various types of VVS syndrome according to VASIS classification was as follows: 60% had cardioinhibitory type of VVS syndrome, 30% had mixed type, and 7% had vasodepressive type. In one patient data on the form of VVS syndrome were not available.

During follow-up period, all patients underwent TT following the same pattern. Tilt training sessions were performed on a special table used for tilt-table tests. A single TT session lasted 45 minutes. When the patient did well with passive standing, provocation with sublingual nitroglycerin was performed after 20 minutes of passive titling to upright position. The final number of training sessions was dependent on the improvement

Table 1. Telephone survey

### Questions to the patient

1. How many syncope episodes did you experience since in-hospital tilt training?
2. How many syncope episodes without prodromal symptoms did you experience since in-hospital tilt training?
3. How many presyncope episodes did you experience since in-hospital tilt training?
4. Which of the following recommendations/techniques you have employed in order to prevent syncope:
  - a) anti-syncope maneuvers — yes/no
  - b) recommendation to increase the amount of liquids consumed — yes/no
  - c) tilt training at home — yes/no
  - d) recommendation to avoid situations associated with high-risk of syncope — yes/no
  - e) other ...
5. How would you rate the effectiveness of the recommendations you were given during hospitalization in order to undergo tilt training?
  - a) anti-syncope maneuvers (1–10)
  - b) recommendation to increase the amount of liquids consumed (1–10)
  - c) tilt training sessions (1–10)
  - d) recommendation to avoid situations associated with high-risk of syncope (1–10)
  - e) other ...
6. How many times were you hospitalized due to syncope since hospitalization in order to undergo tilt training
7. How would you rate your quality of life before in-hospital tilt training (in a scale of 1–10)?
8. How would you rate your quality of life after in-hospital tilt training (in a scale of 1–10)?
9. How would you rate the usefulness of tilt training you underwent at the unit of diagnostics and treatment of syncope in the prevention of syncope recurrences (in a scale of 1–10)?
10. What is your present, i.e. after in-hospital tilt training, level of anxiety associated to the possibility of syncope recurrence?
  - a) reduced
  - b) increased
  - c) unchanged

in the patient's tolerance to prolonged upright posture. Simultaneously with training sessions, patients were educated on reflex syncope prevention. At discharge from the hospital patients were instructed to continue TT at home, once or twice daily, gradually extending time to 30 minutes.

All patients who gave their consent to participate in the study took part in the telephone survey consisting of 10 questions about the therapy they had received (Table 1).

## Results

The mean follow-up period was 1.6 years (min. 6 months; max. 4 years). Patients who underwent in-hospital TT had experienced on average 14 syncope episodes during their lives, with on average 1.5 episodes without prodromal syndromes. Mean number of training sessions per patient was 4 (min 1, max 9).

As indicated by the results of the survey, after discharge from the hospital 22 patients (66,7%) continued TT at

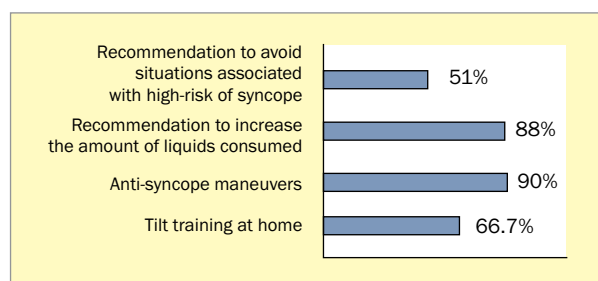
home, 30 patients (91%) applied anti-syncope maneuvers, 29 patients (88%) increased liquids' consumption, and 17 patient (51%) avoided situations associated with high risk of syncope (Figure 1).

Twenty-four patients (72.7%) had no recurrence of syncope during follow-up period. Twenty-two patients (66.7%) had at least one episode of syncope (defined as occurrence of prodromal syndromes of syncope) that was successfully resolved thanks to anti-syncope maneuvers, changing body position or drinking fluids.

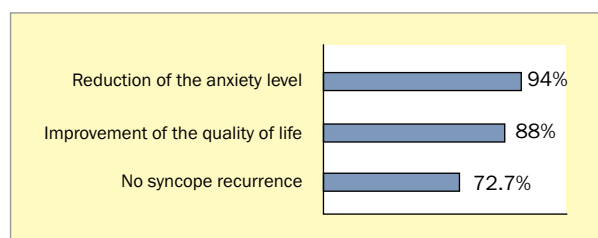
As many as 29 patients (88%) reported improvement in the quality of life after in-hospital training in our Center. Only 3 patients did not perceive any change in the quality of life, and one patient was not able to answer this question.

Thirty-one patients (94%) declared reduction in the anxiety level associated with the possibility of syncope recurrence (Figure 2).

Average rating of usefulness of the therapy provided to patients who were hospitalized to undergo TT and education was 9.3 out of 10 points.



**Figure 1.** Adherence to the recommendations on syncope prevention



**Figure 2.** Effectiveness of applied therapy regarding selected endpoints

## Discussion

One of the reasons for questioning the effectiveness of TT in the prevention of reflex syncope is unclear mechanism of action of this therapy.

Maintaining passive upright position for prolonged time results in venous blood retention in lower limbs. Such dislocation of intravascular volume leads to respective decrease in cardiac output and subsequent reflex baroreceptor activation, which results in increased activity of parasympathetic nervous system. It is considered that the subsequent increase in left ventricular contractility, in the presence of reduced preload, leads to activation of ventricular mechanoreceptors that send strong signal inhibiting sympathetic activity to the brain stem [7].

Morillo et al. observed reduced frequency of syncope episodes induced by tilt-table test in patients who underwent repeated tests in order to assess the reproducibility of the results [8]. The theory assuming desensibility of mechanoreceptors and baroreceptors as a result of repeated tilting to upright position as an explanation of the phenomenon observed in the study of Morillo et al. has become a basis for TT therapy in the treatment of reflex syncope proposed by Ectora et al. in 1998. According to this theory, TT therapy must be applied on a long-term basis, because after some time the effect of desensibilization disappears [1].

However, some researchers claim that above-described mechanism is not the only one responsible for the effectiveness of TT therapy. This may be confirmed by the ob-

servations of the effectiveness of TT sessions performed only periodically. Repeated procedures associated with performing in-hospital and home training of prolonged standing may play a key role in gaining the ability of early identification of prodromal symptoms, which in turn helps preventing syncope in everyday life [9].

The reported data on the effectiveness of TT are very divergent, from complete elimination of spontaneous reflex syncope episodes in the study of Ectora et al., or equally high effectiveness in the study by Girolamo et al. (95.8%), to complete lack of effectiveness compared to control group (the frequency of spontaneous syncope episodes 42.9% vs 47.1%, respectively) during follow-up period in the study by Foglia-Manzillo et al. The results of quoted trials are difficult to compare due to differences in methodology. One of the main methodological differences was the number of in-hospital TT sessions, which might have significant impact on the success or failure of the therapy. It should be remembered that it may be impossible to provide the patient with a high number of in-hospital training sessions, because it is associated with prolonged hospitalization and resultant high costs.

In our study, the effectiveness of the therapy expressed as the lack of syncope recurrence was 72.7%, with mean follow-up period of 1.6 years.

Certainly, such high differences in effectiveness observed in above-mentioned studies are to a large degree caused by different methodology, different patient populations and various follow-up times, and therefore the comparison between them is not fully reliable.

In our study, due to its retrospective observational design, there was no control group. However, considering study population characteristics (mean number of previous syncope episodes: 14) and time from the first episode (mean disease duration: 16.5 years), it can be assumed that estimated one-year risk of syncope recurrence for our patients, based on the statistical model proposed by Sheldon et al., is about 40% [10]. Taking into account such theoretical assumption, therapeutic effectiveness, expressed as no syncope recurrence during follow-up period (mean 1.6 years), was achieved by 72.7% of our patients.

One of the main potential reasons for TT ineffectiveness is lack of adherence to training plan. In our study, we observed high patient adherence to recommendations, including continuation of TT (66.7%), compared to the study by Foglia-Manzillo et al. where only 34% patients followed the recommended TT plan during the follow-up period. In our opinion, in-hospital training phase is a significant factor favorably influencing patients' adherence to recommendations on syncope prevention through increasing patients' conviction about the effectiveness of the therapy proposed. This is reflected by the patients' assessment of the usefulness of the therapy in telephone survey where the mean score was 9.3 out of 10 points.

Another potential cause of low preventive effectiveness of TT in some patients with VVS may be coexistence of non-reflex syncope disturbances related to orthostatic intolerance, such as various forms of orthostatic hypotension or postural orthostatic tachycardia syndrome.

In different studies, disadvantageous effects of recurrent syncope episodes on psychological and psychiatric disorders were reported. It was observed that social relations and everyday activities were frequently disturbed in patients with recurrent syncope syndrome. Linzer et al. reported that patients with recurrent syncope episodes more commonly experienced problems in their relations with family and friends and that usual activities, such as driving a car or low physical activity, might be difficult for them [11]. Furthermore, numerous studies have proven that this group of patients is particularly at risk of psychiatric diseases, mainly depression, panic attacks, somatization disorders and chronic anxiety disorders [12, 13].

Considering quoted data, the results of our study showing the improvement of the quality of life in 88% of patients

and decrease in the level of anxiety in as much as 94% of patients after TT therapy acquire a new meaning in relations to the achievable treatment goals of our therapeutic protocol including in-hospital TT phase.

## Conclusions

1. High adherence to the recommendations on syncope prevention is an important cause of the low recurrence rates of syncope in the study group of patients with VVS. 2. The use of the non-pharmacological therapies such as TT and patient education has an important role for improving the quality of life and for reduction of the anxiety in patients with VVS. 3. A very high subjective assessment of patients with VVS regarding the relevance and effectiveness of the applied therapy needs to be highlighted.

## Conflict of interest(s)

The authors declare no conflict of interest.

## Streszczenie

**Wstęp.** Trening pionizacyjny (TT) jest formą terapii proponowaną pacjentom ze złośliwą lub nawracającą postacią zespołu omdleń odruchowych, które są przyczyną pogorszenia jakości życia oraz niosą ze sobą ryzyko urazów. W tradycyjnym ujęciu TT polega na ćwiczeniu utrzymywania pionowej pozycji ciała przy ścianie. Zastosowanie TT w terapii omdleń odruchowych uwzględniono w wytycznych Europejskiego Towarzystwa Kardiologicznego jedynie jako możliwą do wykorzystania metodę leczenia w wybranej grupie pacjentów (poziom wiarygodności IIb, siła dowodów B).

Celem pracy była ocena skuteczności zintensyfikowanej terapii obejmującej TT prowadzone w warunkach szpitalnych oraz jednoczesnej edukacji z zakresu profilaktyki występowania omdleń odruchowych.

**Materiał i metody.** Badaniem objęto 33 pacjentów (19 kobiet) w wieku 17–69 lat (średnio 40 lat) z zespołem omdleń wazowagalnych (VVS), u których w latach 2010–2015 podczas hospitalizacji w klinice choroby wieńcowej i niewydolności serca zastosowano edukację w zakresie niefarmakologicznego postępowania przeciwomdleniowego oraz TT. Średnia liczba sesji TT wynosiła 4 (1–9). Efekty leczenia oceniono za pomocą ankiety telefonicznej oraz analizy dokumentacji medycznej. Oceniano efektywność zastosowanej terapii w prewencji omdleń, stopień przestrzegania zaleceń lekarskich, wpływ terapii VVS na poziom lęku przed nawrotem omdleń, jakość życia pacjentów, a także subiektywną skuteczność stosowanej terapii.

**Wyniki.** Średni okres obserwacji wynosił 1,6 roku. Spośród badanych 22 osoby (66,7%) kontynuowały TT, 30 osób (91%) stosowało manewry przeciwomdleniowe, 29 osób (88%) stosowało zalecenia dotyczące ilości spożywanych płynów, a 17 osób (51,5%) unikało sytuacji sprzyjających omdleniom. U 24 osób (72,7%) nie doszło do nawrotu omdleń w badanym okresie. Poprawę jakości swojego życia stwierdziło 29 osób (88%), a 31 (94%) odczuło zmniejszenie poziomu lęku związanego z możliwością nawrotu omdlenia. Średnia ocena przydatności odbytej przez badanych pacjentów terapii w prewencji omdleń odruchowych wyniosła 9,3 w 10-stopniowej skali.

**Wnioski.** 1. Wysoki poziom przestrzegania zaleceń lekarskich dotyczących profilaktyki przeciwomdleniowej przez pacjentów z VVS jest istotną przyczyną niskiej częstości nawrotów omdleń w badanej grupie. 2. Zastosowanie TT oraz terapii niefarmakologicznej wpłynęło na polepszenie jakości życia i zmniejszenie poziomu lęku u osób z VVS. 3. Zwraca uwagę bardzo wysoka subiektywna ocena pacjentów z VVS, dotycząca przydatności oraz skuteczności zastosowanego postępowania – TT i edukacji przeciwomdleniowej.

Słowa kluczowe: trening pionizacyjny, omdlenia odruchowe, zespół wazowagalny, test pochyleńowy

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